

App. No. 09/556,132

Amendment mailed December 4, 2003

Re: Office Action mailed June 4, 2003

REMARKS

In response to the Office Action mailed June 4, 2003, the Applicant respectfully requests that the Examiner enter the above amendments and consider the following remarks. Claims 1, 2, 4-9, 13-15, 17, 20, 23, 24, 33, 38, and 41 have been amended to more clearly describe the invention, and new claims 45 through 56 have been added. As a result, claims 1-56 are pending in the application. The Applicant respectfully requests further examination and reconsideration of the application in light of the amendments and accompanying remarks.

Rejection of Claims 1-44 Under 35 U.S.C. § 103(a)

The Examiner rejected claims 1-44 under 35 U.S.C. § 103(a) as being unpatentable over Meyers (US-PAT-NO: 3917564) in view of the conventional knowledge in the art, as displayed by the following references for the definition and description of such cokes:

1. LeCours et al. (US-PAT-NO: 6024863) Col. 5, Lines 22 - 30 & 63 – 68
2. Greenwalt (US-PAT-NO: 5259864) Col. 1, Lines 35 - 45
3. Oshol et al. (US-PAT-NO: 5954949) Col. 1, Lines 65 – Col. 2, Line 20
4. Adams et al. (US-PAT-NO: 5110448) Col. 1, Lines 29 - 40
5. Kapner et al. (US-PAT-NO: 4406872) Col. 1, Lines 28 - 38
6. Hsu et al. (US-PAT-NO: 4291008) Col. 3, Lines 44 - 49

Claims 1 - 44 were also rejected under 35 U.S.C. § 103(a) as being unpatentable

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over Schroeder (US-PAT-NO: 3960701) or Sze et al. (US-PAT-NO: 4326853), or Grindstaff et al. (US-PAT-NO: 4369171) or Schlinger et al. (US-PAT-NO: 3852047), or Hayashi et al. (US-PAT-NO: 4202868), each in view of Meyers (US-PAT-NO: 3917564), Scalliet (US-PAT-NO: 6056882), Bartilucci et al. (US-PAT-NO: 4874505) and Yan (US-PAT-NO: 4096097).

The Applicant respectfully traverses these rejections.

The Current Invention is NOT obvious over Meyers (US-PAT-NO: 3917564) in view of the conventional knowledge in the art. Meyers teaches a “new use” method of the delayed coking process to dispose of industrial and sanitary wastes, including biological sludges and oily emulsions. These wastes are added to the coke in relatively small quantities to apparently maintain solids levels < 5 wt.% during the quench period of injection. Any incidental increase in VCM level (examples 3-5) is caused by the oil content of the wastes injected. Meyers does not teach a change in crystalline structure effected by an increase in VCM in the pet coke, and does not apparently describe the resulting coke's crystalline structure due to its ultimate objective of wastes disposal. Furthermore, Meyers teaches away from excessive VCM, and does not teach the addition of other chemical compounds (e.g., sulfur adsorbents) for the specific purpose of improving the pet coke's combustion characteristics and environmental impacts. In addition, Bartilucci et al. (US-PAT-NO: 4874505) describes

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the addition of oily sludge in the coke quench and subsequent VCM increase (i.e. Meyers) as undesirable. In contrast, the Applicant teaches methods in the coking process to uniformly distribute various selected additives in the petroleum coke via the coke quench media to improve pet coke fuel properties, combustion characteristics, and environmental impacts. These methods provide the means to control the quality and quantity of the additives integrated in the modified pet coke. In many cases, injection of these additives requires the increased porosity and improved adsorption characteristics of the pet coke (e.g., coker feedstocks traditionally producing shot coke) created by the methods and process described in the Applicant's specification. First, the Applicant respectfully submits that Meyers does not teach a process or method to produce porous, sponge coke with or without a volatile content of 13-50% by weight. Furthermore, the Applicant respectfully submits that the present invention's controlled injection of selected additives to improve the pet coke's fuel value is distinguished over the injection of sludges and oily emulsions for waste disposal: not only in method, but also as a different purpose or new use.

The Applicant respectfully submits that neither Meyers nor the other references (noted above) teaches a process or method for the production of porous, sponge coke with the VCM content noted. Meyers assumes a "porous coke" (Col. 4; lines 4-5) in his specification and does not describe VCM levels before adding wastes with oil content. LeCours et al. notes a preference for sponge coke, but primarily teaches the addition of

certain metals to the coker feedstock to passivate the oxidizing tendencies of the metal impurities inherent in petroleum coke, used in the production of carbon anodes. Greenwalt describes the three basic types of pet coke crystalline structure (Shot, Sponge, & Needle), noting that "a typical petroleum coke contains about 10% volatile matter." However, Greenwalt primarily teaches a combustion process with a unique equipment configuration that uses pet coke in the production of molten iron, in a manner that mitigates problems of high sulfur and metals. Oshol et al. also describes the 3 types of coke crystalline structure (at greater length), attributing differences only to the type of feedstock. Oshol et al. teaches an atypical coking process that contacts a molten anhydrous alkali metal hydroxide with heavy petroleum residua to extract substantially all sulfur and heavy metals, while recovering the coke product. Adams et al. briefly discusses sponge and needle coke, but primarily teaches the use of a water soluble, organic cationic surface active compound to more efficiently separate oil and water in the coker dewatering system. Kapner et al. also discusses sponge coke and needle coke, but teaches a post-coker process to calcine and desulfurize pet coke for the aluminum electrode market (vs. fuel coke). Similarly, Hsu et al. briefly notes a sponge coke with "volatile matter content of 11 wt. %.", but teaches another process to calcine and desulfurize coke for the aluminum electrode market. In summary, none of these references teaches a process or method to produce porous, sponge coke with a volatile or VCM content of > 13 wt. %.

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The Applicant acknowledges that one having ordinary skill in the art knows that there are three basic types of pet coke crystalline structures produced by the the delayed coking process: shot coke, sponge coke, and needle coke. The Applicant respectfully submits that 'regular or "sponge" coke is no longer the 'normal product' of the delayed coking process. Over the past years, the coker feedstocks from heavier crudes have yielded as much, if not more, shot coke than "sponge" coke. Due to its "shot" crystalline structure (hard spheres), sulfur content, and troublesome metals, this type of pet coke typically goes to a low-value fuel market, as one of the poorest fuels available. This shot coke does not allow the desired integration of desirable compounds within the coke crystalline structure. The Applicant does not claim to be the first to produce "sponge" coke crystalline structure. Instead, the Applicant has described in the specification of the current invention the various, interrelated factors that determine the three basic types of coke crystalline structures, including coker feedstock characteristics and coker operating conditions. Also, the Applicant described the transitions, hybrids, and mixtures of these coke crystalline structures, including general porosity properties and adsorption characteristics. Finally, the specification of the current invention thoroughly describes the shortcomings of the fuel-grade coke of the prior art, and the modifications in fuel properties, combustion characteristics, and environmental controls necessary to increase its value to traditional coal-fired facilities in the fuel market. The primary application of these principles allows thermal cracking

process users to produce a porous sponge coke (while maintaining acceptable coker product yields or improving them) from feedstocks that would predominantly produce shot coke in normal coker operations of the prior art. Shot coke from these feedstocks would not normally allow the desired integration of desirable compounds (e.g., sulfur adsorbents) within the coke crystalline structure. In this novel process, the Applicant has incorporated independent process options, that allow the coke buyer to specify the types and degrees of coke fuel improvements: fuel properties, combustion characteristics, and environmental controls. These process options may include new uses or new combinations of inventions of the prior art to achieve very different objectives that are not obvious to one skilled in the art. For example, the specification of the current invention describes new and unexpected results from the integration of sulfur sorbents within the very porous structure of the modified pet coke (i.e., vs. sorbent injection into the firebox of the prior art in the field of coal combustion).

In the description, the VCM level of the coke itself is used as a basic operational indicator of when sufficient aromatics (vs. resins & asphaltenes) exist within the coke crystalline structure to create the desired porosity characteristics for the uniform distribution of desirable additives to improve the pet coke's fuel properties, combustion characteristics, and environmental controls. This target VCM level will be different for different feedstock characteristics. That is, increasing the porosity and adsorption character from normal sponge coke increases the percent solids that can be added to

the quench water and pet coke. However, the specification also warns of other VCMs in the pet coke pores that were not true indicators of the pet coke crystalline structure. For example, pet coke VCM levels can be readily increased to levels > 13 wt%, simply by reducing steaming in the quench cycle that normally removes heavy oils trapped in the pores of the sponge coke. Similarly, other VCMs are not intended indicators of the modified pet coke's crystalline structure: the use of quench media by the current invention to intentionally add specific quantities of high-quality and low-quality VCMs to initiate and sustain pet coke combustion. Consequently, pet coke with VCM content > 13 wt% may be found in various patents and other references. However, the prior art of delayed coking teaches away from VCM levels exceeding 12 wt.% due to detrimental impacts on coke calcining and coker product yields. Only after the knowledge presented in the specification of the current invention (e.g., novel principles of how these additives improve the pet coke's fuel properties, combustion characteristics, and environmental impacts) can the uniform integration of desirable additives in a porous coke crystalline structure with specified VCMs in the coke produce the new and unexpected results of the current invention.

The Applicant respectfully submits that any such combination would not be obvious to one skilled in the art. The combination of Meyers' disposal of wastes in the pet coke (via quench water) and conventional knowledge in the art (i.e., sponge coke crystalline structure) is submitted to be improper because this combination would not

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teach the claims of this invention. Furthermore, neither Meyers nor conventional knowledge in the art suggest such a combination, and one skilled in the art would have no reason to make such a combination. Meyers does not teach or suggest a thermal cracking process or method to produce a sponge coke with VCM levels > 13 wt.% within the coke crystalline structure to indicate higher porosity and improved adsorption characteristics. Likewise, conventional knowledge in the art does not teach or suggest a controlled, uniform integration of desirable additives via the thermal cracking process quench. Furthermore, neither Meyers nor conventional knowledge in the art teach or suggest the potential use of increased porosity and improved adsorption characteristics of the coke produced to add chemical compounds to the coke in the quenching portion of the thermal cracking process. Accordingly, there is no motivation in the prior art to combine the references as suggested by the Examiner, and the proposed combination of these references still does not teach or suggest every limitation of the present invention. In addition, the Applicant's own experience has demonstrated this combination is not obvious to ones skilled in the art. The Applicant is working with coker process engineers (e.g., > 15 years experience) at refineries that have been using the patented technology of Meyers for years to dispose of various refinery wastes in pet coke. These coker process engineers have asked the Applicant to maintain the waste disposal of Meyers, while injecting the additives of the present invention. Consequently, this combination of references is clearly not obvious to ones skilled in

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the art.

In conclusion, the Applicant respectfully submits that the novel thermal cracking process options and methods of the current invention are (1) unobvious to one skilled in the art and (2) these distinctions of the present invention provide surprising and unexpected results and are patentable under Section 103 because the increased porosity and improved adsorption characteristics of the modified coke allow the integration of various desirable chemical compounds (e.g., sulfur adsorbents, high quality VCM, and oxygen-containing hydrocarbons) during the quench of the thermal cracking process (e.g., delayed coking) which can improve the coke's fuel properties, combustion characteristics, and environmental impacts. Therefore, Meyers and conventional knowledge in the art provide no motivation to combine or modify the references as suggested by the Examiner in order to arrive at the claimed invention.

The Current Invention is Not Obvious from the Combination of Various Cited References in the Prior Art. Claims 1-44 were rejected as being unpatentable over Schroeder (US-PAT-NO: 3960701) or Sze et al. (US-PAT-NO: 4369171) or Grindstaff et al. (US-PAT-NO: 4369171) or Schlinger et al. (US-PAT-NO: 3852047) or Hayashi et al. (US-PAT-NO: 4369171) each in view of Meyers (US-PAT-NO: 3917564), Scalliet (US-PAT-NO: 6056882), Bartilucci et al. (US-PAT-NO: 4874505) and Yan (US-PAT-NO: 4096097). The Applicant respectfully submits that any combination of these

references would not be obvious to one skilled in the art. Furthermore, Schroeder, Sze et al, Grindstaff et al, Schlinger et al, and Hayashi et al. do not teach processes or methods that produce pet coke with the same type of crystalline structure and VCM content taught by the current invention. Similarly, Meyers, Scalliet, Bartilucci et al, and Yan do not achieve the objectives nor the claim limitations of the current invention. Any combination of these various references is submitted to be improper because none of these references suggest any such combination, and one skilled in the art would have no reason to make such a combination. Only after the knowledge presented in the specification of the current invention (e.g., novel principles of how these additives improve the pet coke's fuel properties, combustion characteristics, and environmental controls) can the uniform integration of desirable additives in a porous coke crystalline structure with specified VCMs in the coke produce new and unexpected results of the current invention.

The Applicant respectfully submits that Schroeder, Sze et al, Grindstaff et al, Schlinger et al, and Hayashi et al. do not teach processes or methods that produce pet coke with the same type of crystalline structure and specified VCM content or objectives taught by the current invention. Schroeder teaches the conversion of non-coking coals to coking coals by hydrogenation at much higher pressures than the current invention (500 to 4000 psi vs. <100 psi), and does not describe the resulting pet coke's crystalline structure nor the nature of the VCM contained therein. Apparently, Schroeder does not

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address these issues due to its ultimate objective of producing a high-density (i.e., non-porous) coke with very low VCM (e.g., < 3%) after calcining for the manufacture of electrodes for the steel industry. Similarly, Sze et al. uses a high-pressure coal liquefaction process to develop a "soft" coke with 16-30 wt.% VCM content. Sze et al. describes heater outlet temperature controls as the only means to affect such coke. Using only heater outlet temperature control to achieve these high VCM levels can lead to unmanageable pitch content of the resulting coke, as described by the Applicant in the specification of the current invention. Again, Sze et al. does not apparently describe the resulting coke's crystalline structure nor the nature of the coke's VCM due to its ultimate objective of blending this coke with bituminous coal to be carbonized (i.e., non-porous structure w/< 3 wt.% VCM) for use as metallurgical coke. Grindstaff et al. does not teach the production of very porous sponge coke with VCM > 13 wt.%, but teaches the reduction of pet coke VCM levels via hot solvent extraction. Apparently, the hot extraction is not effective unless the pet cokes VCM levels exceed 10 wt.%. Since VCMs tied up in the coke crystalline structure would not be readily extracted, one skilled in the art can conclude that the high levels of VCM in Table 1 are a result of poor coker process steaming practices, which are used to extract trapped oils (VCMs) on the surface of the coke within the coking process. As such, Grindstaff et al. does not teach a change in crystalline structure effected by an increase in VCM in the pet coke, and does not apparently describe the resulting coke's crystalline structure nor the nature of

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the coke's VCM due to its ultimate objective of producing carbon anodes (i.e., non-porous structure w/< 3 wt.% VCM) for Hall aluminum cells. Schlinger teaches "manufacturing clusters of petroleum coke pellets which are characterized by unusually high density and low porosity" (col. 1, lines 33-40). Though the seeding particles are "sponge-like," the crystalline structure of the high-density clusters of the product coke pellets is more like the consistency of shot coke or fluid coke than sponge coke. As noted in col. 10, lines 48-58, the high levels of VCM in Table 2 are the result of poor coker process steaming practices, which are used to extract trapped oils (VCMs) on the surface of the coke within the coking process. As such, Schlinger does not teach a change in crystalline structure effected by an increase in VCM in the pet coke, and does not apparently describe the resulting coke's crystalline structure nor the nature of the coke's VCM due to its ultimate objective of use in metallurgical processes, including blast furnace coke. Finally, Hayashi et al. teaches "the production of high-density carbon materials" (Abstract). As noted in col. 5, lines 1-5, the high levels of VCM in Claim 6 are the result of poor coker process steaming practices, which are used to extract trapped oils (VCMs) on the surface of the coke within the coking process. As such, Hayashi et al. does not teach a change in crystalline structure effected by an increase in VCM in the pet coke, and does not apparently describe the resulting coke's crystalline structure due to its ultimate objective of use in a process for making high-density carbon materials, for various uses other than fuel. In summary, none of these

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cited references teaches a change in crystalline structure effected by an increase in the VCM of the pet coke.

The Applicant respectfully submits that Meyers, Scalliet, Bartilucci et al., and Yan do not achieve the objectives nor the claim limitations of the current invention. As noted previously, Meyers teaches a "new use" method of the delayed coking process to dispose of industrial and sanitary wastes, including biological sludges and oily emulsions. Apparently, these wastes are added to the coke in relatively small quantities to maintain solids levels < 5 wt.% during the quench period of injection. Any incidental increase in VCM level (examples 3-5) is caused by the oil content of the wastes injected. Meyers does not teach a change in crystalline structure effected by an increase in VCM in the pet coke, and does not apparently describe the resulting coke's crystalline structure due to its ultimate objective of wastes disposal. Furthermore, Meyers teaches away from excessive VCM levels, and does not teach the addition of other chemical compounds (e.g., Sulfur adsorbents) for the specific purpose of improving the pet coke's combustion characteristics and environmental impacts. Scalliet teaches the application of shear forces via various types of mills to separate oil from water and solids in a "tight" emulsion, often existing in waste sludges. The resulting "solids slurry" (water w/solids) can be used as the coker quench media. Scalliet does not teach the controlled addition of desirable additives to improve (in various degrees) the fuel properties, combustion characteristics, and/or environmental

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impacts of the pet coke. Bartilucci et al. (US-PAT-NO: 4874505) describes the addition of oily sludge in the coke quench (i.e. Meyers) as undesirable, and teaches the segregation of waste sludges according to oil content. Only non-oily wastes are injected in the coke quench to avoid the "undesirable" addition of VCMs in Meyers. Bartilucci et al. does not teach the controlled addition of desirable additives to improve (in various degrees) the fuel properties, combustion characteristics, and/or environmental impacts of the pet coke. Yan teaches a method for the preferential formation of sponge coke (vs. shot coke) "suitable for use in the manufacture of electrodes" (emphasis added) via improved grindability characteristics. In contrast, the Applicant incorporates the principles of this expired patent in the specification of the current invention in a novel combination of methods and "new use" for increasing the porosity and adsorption character of the pet coke to improve the ability to uniformly distribute desirable additives into the modified pet coke. In turn, uniform integration of these additives has the objective of improving the fuel properties, combustion characteristics, and/or environmental impacts of the modified pet coke, not the manufacture of electrodes.

The Applicant respectfully submits that none of these cited references teaches the potential use of increased porosity and improved adsorption characteristics of a modified pet coke to add chemical compounds to the coke in the quenching portion of the thermal cracking process. The Applicant respectfully submits that any combination

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of these cited references would not be obvious to one skilled in the art. The combination of porous "sponge" coke with VCM content > 13 wt.% and the addition of waste sludges via the coke quench for improving the pet coke's combustion characteristics and environmental impacts is submitted to be improper because none of the cited references suggest such a combination, and one skilled in the art would have no reason to make such a combination. Furthermore, none of the cited references teach or suggest the potential use of increased porosity and improved adsorption characteristics of a modified coke to add chemical compounds to the coke in the quenching portion of the thermal cracking process. Accordingly, there is no motivation in the prior art to combine the references as suggested by the Examiner, and the proposed combination of these references still does not teach or suggest every limitation of the present invention. These distinctions of the present invention provide surprising and unexpected results and are patentable under Section 103 because the improved adsorption characteristics of the modified coke allow the integration of various desirable chemical compounds (e.g., sulfur adsorbents, high quality VCM, and oxygen-containing hydrocarbons) during the quench of the thermal cracking process (e.g., delayed coking) which can improve the coke's fuel properties, combustion characteristics, and environmental impacts. Therefore, none of the cited references provide any motivation to combine or modify the references as suggested by the Examiner in order to arrive at the claimed invention.

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Since the novel physical features of the Applicant's modified petroleum coke provide these new and unexpected results over any reference, the Applicant submits that these new results indicate unobviousness and hence patentability. Therefore, the Applicant respectfully submits that no combination of the cited references can support the rejection of claims 1-44 under 35 U.S.C. § 103(a). Accordingly, the Applicant respectfully requests reconsideration and allowance of the present application with the above-amended claims.

Rejection of Claims 1-44 Under Double Patenting Doctrine

Claims 1-44 were rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-21 of U.S. Patent No. 6,168,709 in view of Meyers (USP 3917564), Scalliet (USP 6056882), or Bartilucci et al. (USP4874505). The Applicant respectfully traverses the rejection.

The Applicant respectfully submits that claim 1 has been amended to distinguish over claims 1-21 of U.S. Patent No. 6,168,709 B1. None of the cited references teach the use of increased porosity and improved adsorption characteristics of coke to add chemical compounds to the pet coke in the quenching portion of the thermal cracking process. In addition, Yan does not suggest using carbon adsorption properties of the modified coke without removal from the coke drum and further treatment. Furthermore, none of the cited references provides any motivation to combine or modify the

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references as suggested by the Examiner in order to arrive at the claimed invention.

Therefore, the Applicant respectfully submits that claims 1-21 of U.S. Patent No. 6,168,709 in view of Meyers (USP 3917564), Scalliet (USP 6056882), or Bartilucci et al. (USP4874505) cannot support the rejection of claims 1-44 under the obviousness-type double patenting doctrine.

Claims 1-44 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 19-33 of copending Application No.09/763,282. The Applicant respectfully traverses the rejection.

The Applicant respectfully submits that Claims 19-33 of Copending Application No. 09/763,282 will be amended in response to the USPTO office action dated June 11, 2003, to distinguish over the claims of this continuation-in-part to avoid the judicially created doctrine of obviousness-type double patenting.

Therefore, the Applicant respectfully requests the Examiner to hold the provisional double patenting rejection in abeyance.

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Conclusion

The Applicant has distinguished claims 1-56 over the cited references. Therefore, the Applicant respectfully submits that the present application is now in condition for allowance, and such action is earnestly requested.

Respectfully submitted,

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